



NASA SBIR 2016 Phase I Solicitation

A1.04 Aerodynamic Efficiency - Active Flow Control Actuation Concepts

Lead Center: LaRC

Participating Center(s): AFRC

Active flow control (AFC) technology has the potential to be a key contributor to achieving NASA's aeronautics goal of revolutionizing the energy efficiency and environmental compatibility of fixed wing transport aircraft. Active flow control is the on-demand addition of energy into a boundary layer for maintaining, recovering, or improving vehicle performance. Since Prandtl's discovery of the boundary layer, AFC actuation methods have included steady mass transfer via suction or blowing, and unsteady perturbations created by zero net mass flux actuators, plasma actuators, and fluidic oscillators. Previous wind tunnel and flight tests demonstrated that this technology is capable of improving vehicle performance by reducing and/or eliminating separation and increasing circulation. When integrated into a transport aircraft, therefore, AFC would result in smaller control surfaces creating less drag and thereby less fuel consumption during flight. Widespread application of the technology on commercial transports, however, requires that AFC actuators and systems be energy-efficient, reliant, and robust. Another challenging aspect of the design of the actuation system involves understanding how and where to integrate the actuator into the vehicle. Computational tool development is also needed in parallel with actuator development to enable a more synergistic approach to active flow control system design thus maximizing the potential benefits of an AFC system.

This solicitation is for robust, energy-efficient, reliable actuation systems with the control authority needed to control turbulent separation thus improving circulation on simply hinged flaps systems and other aircraft control surfaces during the subsonic portion of the flight regime and/or to control shock induced separation on vehicles in cruise during the transonic portion of the flight regime.

Areas of specific interest where research is solicited include but are not limited to the following:

- Experimental or computational investigations aimed at control of turbulent boundary layer separation due to large adverse pressure gradients or shock/boundary layer interactions.
- Development of novel, energy-efficient, and robust actuators for controlling boundary layer separation.
- Development of computational tools to model the performance of a proposed actuator concept.
- Development of closed-loop active flow control systems with demonstrated improvements in AFC efficiency measured by the energy consumed by the AFC actuator.
- Experimental evaluation of realistic AFC actuators applied to separated flows.
- Experimental and computational studies that demonstrate the efficiency of the proposed actuation system.
- Development of computational tools to model the flowfield resulting from the application of active flow control on an airfoil or wing.